

Altitude Compensating Nozzles (ACN)

Completed Technology Project (2011 - 2016)



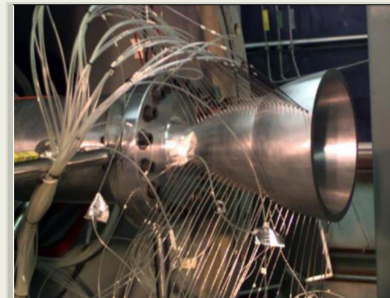
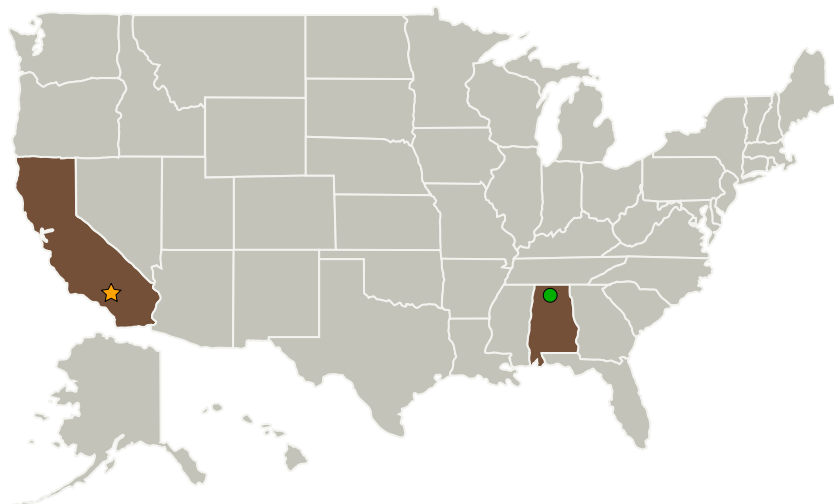
Project Introduction

An Altitude Compensating Nozzle (ACN) enables the nozzle flow to adjust with the ambient pressure as it decreases with altitude so that the plume is never significantly over or under-expanded. The performance of ACNs can be near optimal over most of the flight. Hence, mission integrated performance with an ACN could be higher than with a Conventional Bell (CB) nozzle. The purpose is to advance the TRL of ACNs through static ground tests, and ultimately by demonstrating this technology through flight test. The primary near-term objective is to advance Dual Bell (DB) nozzle technology, and ultimately the team has plans to advance the TRL of other ACN conceptual designs (e.g. aerospike, clustered aerospike, etc.).

Anticipated Benefits

A study at MSFC shows that a 1st stage aerospike nozzle produces: Up to a 3% gain in 1st stage average Isp and Thrust. Up to a 10% payload benefit in Delta IV Medium to LEO.

Primary U.S. Work Locations and Key Partners



Dual-bell nozzle during testing at the NASA MSFC Nozzle Test Facility (NTF)

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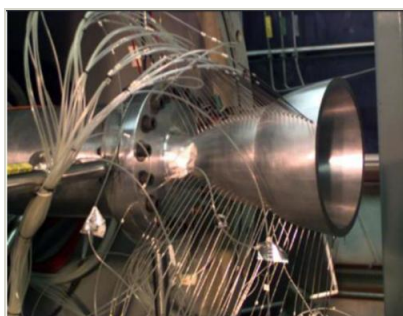


Organizations Performing Work	Role	Type	Location
★ Armstrong Flight Research Center (AFRC)	Lead Organization	NASA Center	Edwards, California
● Marshall Space Flight Center (MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations

Alabama	California
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Images



Project Image

Dual-bell nozzle during testing at the NASA MSFC Nozzle Test Facility (NTF)

(<https://techport.nasa.gov/image/35803>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Armstrong Flight Research Center (AFRC)

Responsible Program:

Center Innovation Fund: AFRC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

David F Voracek

Project Manager:

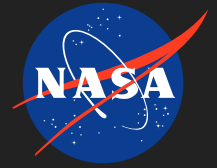
David F Voracek

Principal Investigator:

Daniel S Jones

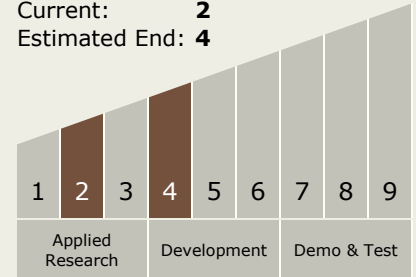
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Technology Maturity (TRL)

Start: 2
Current: 2
Estimated End: 4



Technology Areas

Primary:

- TX01 Propulsion Systems
 - └ TX01.2 Electric Space Propulsion
 - └ TX01.2.4 Electrothermal